Testimony to the Public Health Committee, Connecticut General Assembly, on HB 6678 and its Provision to Permit Use of State-of-the-art Geothermal Well Technology

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Dear Senator Harris, Representative Ritter, and Members of the Committee:

My name is Sam Olmstead and I represent Yale University.

As you may know, we at Yale University have a strong commitment to sustainability and have set an aggressive goal of reducing its greenhouse gas emissions by 10% below our 1990 levels by 2020, even as we develop the campus. In order to do this, we are employing multiple strategies as part of a comprehensive sustainability plan. The use of state-of-the-art geothermal well systems is a key component of our strategy.

The standing column geothermal well systems that we propose for future developments will allow us to get the maximum benefit for the environment. However, such systems cannot be deployed in key future developments – especially the building of two new residential colleges – under current Connecticut statutes and regulations, even though such systems have proven reliable and safe in other places.

These two new colleges will be important for economic development in Connecticut, as they will allow Yale College to add 800 more students. This addition of students will in turn lead to more permanent faculty and staff, in addition to the hundreds of construction jobs on the project itself. Just as we hope to maximize the economic benefits of this future growth for Connecticut, so too we hope to maximize the sustainability of this project for the environment.

We thus seek change in the statutes to enable us to be sure that we can design and build a standing column geothermal well system in our new residential colleges. While these colleges will not be constructed for a few years, planning is now underway in earnest and it is important that our design team know whether or not they can move forward with confidence in including the best possible geothermal well system in the plans, which is why we seek your action this session.

We have been working closely with the Department of Public Health on this issue and we greatly appreciate the language they have drafted to enable us to apply for permission to construct standing column geothermal wells. This language, incorporated in House Hill 6678, will achieve the goal we have of utilizing the most effective geothermal well technology and it will also allow the State to use our project as an important study for how to revise statutes and regulations in the future. The language in the bill will help Connecticut be more sustainable and we urge its approval.

Thank you for your consideration and I would be happy to answer any questions you may have.

Attachment: background document on geothermal well technology

Standing Column Geothermal Systems

Yale University

Geothermal systems planned for Yale University use standing column wells. As described and illustrated below, the design, hydraulics and engineering controls of a standing column geothermal system are unique.

Characteristics of a Standing Column Well

A standing column geothermal system differs significantly in design and operation from the open loop system described in *Report to the General Assembly: Recommendations for Regulation of Geothermal Wells*.[1] In particular, a standing column well has the following characteristics:

- There is no net extraction of water from a standing column well.
  - The system is not a "withdraw-recharge" open geothermal system where the groundwater is drawn from a production well and then re-injected to the subsurface at a separate well or wells.
  - The Yale system is designed and constructed to have no bleed to a storm drain, sewer or infiltration structure,
  - The extraction rate from a standing column well is equal to its return rate. The building control system is programmed to continuously monitor the water level in the wells and the flow to each well, and can automatically adjust valves to control the extraction rate so that it equals the return rate.
- A standing column well does not create a hydraulic gradient because the water is circulated within the well and borehole.
  - Because the net extraction rate is essentially zero from all the wells, a standing-column geothermal system does not create a cone of depression or capture zone that could alter the movement of groundwater.

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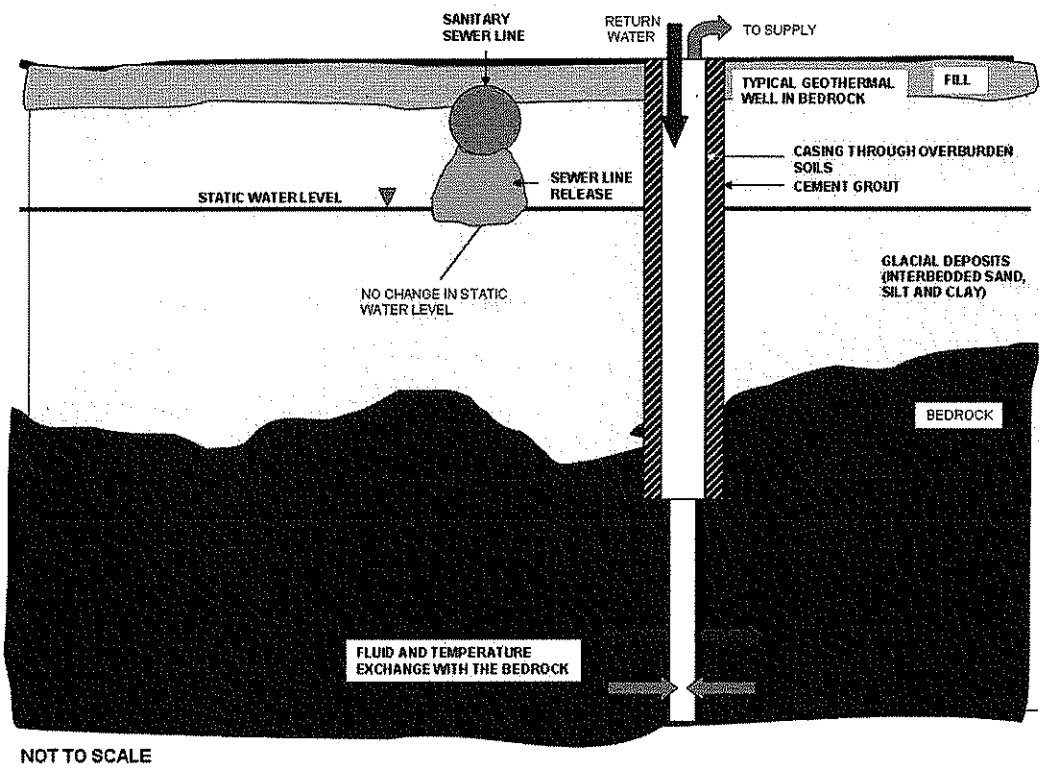
[1] *Report to the General Assembly: Recommendations for Regulation of Geothermal Wells,* Connecticut Department of Public Health, Revision 2.0, March 5, 2007.

- Because the standing column geothermal system creates no hydraulic gradient, nearby contamination (if present) is not drawn into the well. A standing column well does not act as a "sink" for potential contamination. As a result, the risk of contamination from shallow sources, such as sewer lines, is insignificant.
- A standing column well's operation does not displace or re-direct contaminants toward other potential receptors, such as water supply wells or other water resources. Based on Yale's regional and local setting, a standing column geothermal well poses no risk of altering groundwater flow patterns that would direct contaminants toward public water supplies.

- A standing column well is not designed to operate as a water supply well.

Schematic Illustration of a Standing Column Geothermal Well



Other System Design and Operational Features

Other design features protect the potable water supply and prevent near surface contaminants (such as from a leaky sewer line or wastewater leaching field) from migrating to the underlying bedrock.

- The groundwater is used for heat transfer only. In the building, the groundwater flows through a sediment filter and a heat exchanger. A portion of the groundwater may flow through a water softener before it is returned to the well.
- The piping for the geothermal system is isolated from the potable water supply by two backflow preventers, in series. The first backflow preventer isolates the building potable water supply from the public main. The second backflow preventer isolates the mechanical room water supply from the building potable water supply. Accessible piping will be prominently labeled as "Non-Potable."
- The standing-column wells draw from bedrock. Wells are typically 8-in. diameter and 1,500-ft deep.
- Unlike the typical bedrock water supply well, the casing of a standing column geothermal well is grouted to isolate the overburden soils and groundwater from the underlying bedrock. The well's steel casing is advanced deeper into the rock (typically around 30 ft). The well is an open rock borehole below the casing.
- New storm drains and sewers constructed in proximity of the system will meet the tight pipe criteria listed in the Table 2-C of the Technical Standards for Subsurface Sewage Disposal Systems."[2]
- A standing column well requires a well pit for maintenance access. To prevent surface water from entering the well via the well pit, piping and conduits entering the well have sanitary seals that make water-tight connections.

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[2] "Accepted Tight Pipe for Building Sewer & distribution Piping within 25 Feet of open Water course or Drain, or Groundwater or Surface Water Piping within 25 Feet of Subsurface Sewage Disposal System," Connecticut Public Health Code Regulations, January 2007.

Local Factors Also Reduce the Risk of Standing Column Systems

A municipal water supply system is the source of drinking water in the area of Yale University's proposed new standing column geothermal systems. These sites are within a groundwater zone classified by the State of Connecticut as GB. GB groundwater is "presumed not suitable for human consumption without treatment," according to the Connecticut Department of Environmental Protection (DEP) Water Quality Standards and Classifications. Because of this classification, and because municipal water is available, it is highly unlikely that groundwater in the vicinity will ever be used as a source of drinking water.

Alternate Requirements for Standing Column Systems

The Connecticut Department of Environmental Protection (DEP) requires permits for water diversion and discharge for the geothermal systems described above. Yale will obtain these water diversion and discharge permits.

The Connecticut Department of Public Health (DPH) has applied water supply well standards to standing column geothermal systems. However, because of the unique hydraulics and engineering controls described above, the location standards for standing column geothermal wells need not be so restrictive.

Further, DPH's application of water supply standards to geothermal systems severely limits their use in urban areas. In urban areas, space for drilling and installing wells is limited, and sewers and storm drains are commonly located in roadways. These site constraints prevent standing column wells from meeting water supply well requirements for separation distances from city drains and sewers, as well as other setback and location requirements in Connecticut Public Health Code Section 19-13-B51d.